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APPLICATION FOR LETTERS PATENT OF THE UNITED STATES

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TITLE OF INVENTION:

Calls Spanning Sub-Domains With Independent Call Linkage

TO WHOM IT MAY CONCERN, THE FOLLOWING IS A SPECIFICATION OF THE AFORESAID INVENTION

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CALLS SPANNING SUB-DOMAINS WITH INDEPENDENT CALL LINKAGE

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention is related to computer telephony communications and more particularly, to providing call completion services between communications devices at different computer telephony interface (CTI) platforms.

Background Description

A typical computer telephony interface (CTI) integrates telephony communications with computer data communications, e.g., connecting a public switched telephone network (PSTN) to a local area network (LAN) and/or the Internet. The telecommunications connection point is typically referred to as an endpoint and that endpoint is in what is known as a switched sub-domain in the particular communications network. Normally, the endpoints are monitored by a software application such as what are known as computer supported telecommunications applications (CSTA) that provide application service interfaces for switching, computing and special resource functions. Calls made between endpoints can traverse multiple communications infrastructures, e.g., a session initiation protocol (SIP) in an Internet protocol (IP) based network, a switched circuit network (SCN) or an enterprise private network, such as a private branch exchange (PBX) based network.

As each call traverses between infrastructure endpoints, each CTI may assign a different, unique call identification (ID) attribute to it that the switching function uses to represent a valid call. In CSTA a call ID has the form of: callID (M) Octet String. The maximum length supported by the switching function is provided via the capabilities exchange services. These IDs are created by the switching function and are globally unique among all calls within the switching sub-domain. For example, a

call may originate with a 10 digit telephone number (800-555-5421), a CTI to an IP network may assign one CSTA attribute (e.g., mobile@10.23.23.244) to identify the call as it traverses the IP network and another CTI may assign another, unique 3 digit ID (e.g., 987) as it exits the IP network at a second endpoint.

So, normally, the CSTA at each endpoint assigns the call linkage attributes to calls traversing between endpoints. Then, the CSTAs tunnel CSTA attributes (call linkage) thru a signaling channel with the call to identify and maintain the identity of events with the call. These attributes correlate events from the monitored endpoints. However, many infrastructure protocols may not support tunneling the call linkage attributes. So, unfortunately, these types of infrastructures have previously been unavailable for use in a CTI platform.

Thus, there is a need for maintaining the identity of events with respective calls in communications infrastructures that do not support call linkage attribute tunneling.

SUMMARY OF THE INVENTION

It is a purpose of the invention to provide a global view of a call to an application that monitors/controls devices in multiple CTI(/CSTA) sub-domains;

It is another purpose of the invention to enable endpoints to tunnel calls between each other even when a signaling channel is unavailable for passing call linkage with the calls.

The present invention relates to a communications network, method and computer program product for managing network calls. Calls placed between different switching sub-domains are passed over a dedicated line between endpoints. Call linkage for the calls pass in call context objects separate from the calls and need not pass in a signaling channel with the calls.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, aspects and advantages will be better understood from the following detailed description of a preferred embodiment of the invention with reference to the drawings, in which:

Figure 1 shows an example of a preferred embodiment communications network, wherein calls tunnel between endpoints regardless of infrastructure protocol;

Figure 2 shows an example of steps for call establishment of an incoming call between endpoints connected by communications infrastructures;

Figure 3 shows an example of a call placed between mobile stations in different switching sub domains over communications infrastructures.

DESCRIPTION OF PREFERRED EMBODIMENTS

Turning now to the drawings and more particularly, Figure 1 shows an example of a preferred embodiment communications network or Public Land Mobile Network (PLMN) 100, wherein calls tunnel between endpoints regardless of infrastructure protocol. In particular, calls may tunnel between base station controllers (BSCs) 102, 104, each of which includes one or more cells serviced by a local base transceiver station (BTS) 106, 108. Each BSC 102, 104 may be a different switching sub-domain (e.g., a different service area) within the network 100. Mobile Subscriber (MS) units or wireless communications devices 110, 112, 114, 116 in the cells wirelessly communicate through the particular local base station 106, 108. Each MS 110, 112 114, 116 may be any appropriate wireless communications device such as a second generation (2G) or third generation (3G) wireless communications device, e.g., a typical cellular phone. Further, each switching sub-domain is connected to a number of communications network infrastructures 118, 120 through an endpoint, e.g., a gateway server 122, 124. In particular, the communications network infrastructures 118, 120 may or may not allow passing call linkage information in a

signaling channel. Examples of suitable such communications network infrastructures include, for example, a session initiation protocol (SIP) in an Internet protocol (IP) based network 120, a switched circuit network (SCN) 118 or an enterprise private network, such as a private branch exchange (PBX) based network.

So, for example, the communications networks 118, 120 may include: a standard integrated services digital network (ISDN) with common channel signaling (CCS) wherein signaling for all of the other channels of the link is carried on one dedicated (common) channel; and/or a channel-associated signaling (CAS) wherein each channel contains its own signaling. Each gateway server 122, 124 is an endpoint running computer supported telecommunications applications (CSTA) and, thereby, providing application service interfaces for switching, computing and special resource functions. Preferably, CSTA in endpoints 122, 124 include a call linkage facility (e.g., implemented in the gateway server) as CSTA middleware and that is provided, for example, in a software development kit (SDK). Thus, each endpoint 122, 124 provides CSTA call linkage, e.g., over the Internet 120, for calls spanning such multiple infrastructures 118, 120 (spanning calls) tunneling between endpoints 122, 124 and, further, without requiring specific signaling channels for passing any particular spanning call information, regardless of whether any such signaling channels available.

Spanning calls are passed between endpoints 122, 124 using an address or number from a pool of addresses or numbers (such as dial in direct (DID) numbers) allocated in each endpoint 122, 124. Calls between stations at different endpoints 122, 124 and traversing infrastructures 118, 120 are established by first placing the call to a designated number from the pool of numbers. Then, the local routing devices (e.g., a gateway server in a receiving endpoint 122, 124) pass call linkage independently and redirect the call to the called destination. So, call linkage is established and passed between endpoints 122, 124 independent of the call, uniquely correlating calls between endpoints. Advantageously, unlike prior art communications networks, even when a signaling channel is unavailable for call linkage, calls are pass between endpoints 122, 124 as if one were available.

Figure 2 shows steps for call establishment 130 with reference to the PLMN 100 of Figure 1 for an incoming call 132 between endpoints (e.g., 122, 124) connected by communications infrastructures (e.g., 118, 120) according to a preferred embodiment of the present invention. In step 134 a call context object is created for the new call and a globally unique call linkage value is assigned to that call. If in step 136 the call is to remain in the originating sub-domain (e.g., directed from MS 110 to MS 112), then the call is routed normally in step 138. However, if in step 136 the CSTA in the originating endpoint 122 recognizes that the call is intended to reach a destination in a MS in a different CSTA sub-domain, e.g., MS 114; then, continuing to step 140 the CSTA in the originating endpoint 122 substitutes one of the circular pool numbers for the MS destination number. Next, the CSTA in the originating endpoint 122 caches the call ID, the pool number, and the original destination number in the call context object created in step 134; and, forwards the call context object to the destination switching sub-domain through connecting communications infrastructures, e.g., over the Internet 120. Substantially coincidentally, in step 142 the CSTA in the originating endpoint 122 sends the call on the pool number. In step 144 the call arrives on one of the pooled lines at receiving end and the local routing device (e.g., the gateway server or endpoint 124) receives the call context object and identifies the incoming pool number call as being from another sub-domain. In response in step 146, the CSTA in the receiving endpoint 124 retrieves original destination information from the call context object. Then, in step 148, the CSTA in the receiving endpoint 124 deflects the call to its original destination, MS 114; and, coincidentally in step 150, call events for the original destination are linked to the call context object and reported with the call linkage ID.

Figure 3 shows an example 160 of a spanning call placed between mobile stations 110 and 114 in different sub domains 102 and 104, respectively, over communications infrastructures with reference to the call establishment example 130 of Figure 2. So, an incoming spanning call 162 originates in MS 110 at 123 in sub-domain 102 directed to 456, which is not associated with a MS in sub-domain 102. The local CSTA (e.g., operating in 122 in Figure 1) in sub-domain 102 creates a call context object 164 in step 134 for the new call and assigns a globally unique call linkage value (e.g., in ECMA, a globallyUniqueCallLinkageID Octet String that

specifies the globally unique call linkage identifier, no more than 16 octets) to that spanning call. Since the spanning call is directed to a destination in a different sub-domain, MS 116 identified by 456 in sub-domain 104, then, in step 140 one of the circular pool numbers (e.g., 300) is substituted for the destination number. In this example, the circular pool includes eleven numbers (300 – 310) that are assigned on a rotating basis. Next, the originating CSTA in sub-domain 102 caches the call ID, the pool number, and the original destination number in the call context object 164. Then, the originating CSTA in sub-domain 102 sends the call 166 to the pool number (300) and forwards the cached call context object 164 in step 142. The local CSTA (e.g., 124 in Figure 1) at the receiving end 104 identifies the spanning call 166 in step 144 from the incoming call number and the call context object 164 as being associated with the pool number and so, from another sub-domain, 102 in this example. The receiving end CSTA in sub-domain 104 responds in step 146 by caching the call ID in a call context 168. Then, the receiving end CSTA in sub-domain 104 deflects the call 170 in step 148 to its intended destination, MS 114 in this example and, coincidentally, reports events for the original destination with the call linkage value (i.e., the call context object created in step 134) in step 150.

Advantageously, since the local CSTAs at each endpoint maintain call linkage outside and independent of the call, calls can be tunneled between endpoints regardless of whether a signaling channel is available in the connecting infrastructure.

While the invention has been described in terms of preferred embodiments, those skilled in the art will recognize that the invention can be practiced with modification within the spirit and scope of the appended claims.